REPUBLIC OF RWANDA

EASTERN PROVINCE

PHYSICS II

2023-2024

…/03/2024 8:30AM-11:30AM

RWAMAGANA DISTRICT

ADVANCED LEVEL DISTRICT COMPREHENSIVE

ASSESSMENT FOR SECOND TERM,2023-2024.

SUBJECT: PHYSICS

LEVEL: SENIOR five (S5)

/100marks

DURATION :3 HOURS

COMBINATIONS:

PHYSICS–CHEMISTRY- BIOLOGY (PCB)

PHYSICS - CHEMISTRY- MATHEMATICS (PCM)

MATHEMATICS-PHYSICS–GEOGRAPHY (MPG)

MATHEMATICS-PHYSICS–COMPUTER (MPC)

INSTRUCTIONS:

1) Do not open this question paper until you are told to do so.
2) This paper consists of **TWO** sections: **A** and **B**

SECTIONA: Attempt all questions **(70marks)**

SECTIONB: Attempt any **THREE** questions **(30marks)**

useful constants:

Magnitude of the electronic charge = $1.6\ 10^{-19}C$

Speed of light in vacuum/air, $c=3x10^{8}m/s$

Planck's constant, $h=6.63x10^{-34}J.s$

Acceleration due to gravity, $g=9.81m.s^{-2}$

Coulomb's constant, $K= 9x10^{9}\ Nm^{2}C^{-2}$

SECTIONA: Attempt all questions **(70marks)**

1. Define the term "black body". **(2marks)**
2. What do you understand by forced oscillations? **(3marks)**
3. State Kirchhoff 'law of voltage. **(3marks)**
4. Differentiate renewable energy and non-renewable energy. **(4marks)**
5. Define: **(4marks)**
   a. Electric field
   b. Electric potential
6. State Kepler's third law of planetary motion. **(3marks)**
7. The following parameters are related to Photoelectric effect except:
   A. Photoelectric Current **(3marks)**
   B. Stopping Potential
   C. Potentiometer
   D. Threshold Energy
   E. Work Function.
8. Complete each of the following statements using appropriate term from the box. **(4marks)**

Amplitude	frequency	displacement
Period	velocity	restoring force
Angular frequency	kinetic energy	

   a. In simple harmonic motion (SHM), the displacement is maximum when the …… is zero.
   b. The total energy of a simple harmonic oscillator is proportional to the square of ……

9. a) An example of non-fossil fuel is: **(4marks)**

   i. Solar energy

   ii. oil

   iii. coal

   iv. natural gas

   b) An example of fossil fuel is:

   i. nuclear energy

   ii. wind

   iii. coal

   iv. solar power.

10. a) State the Kepler's second law of gravitation. **(3marks)**

    b) what is the difference between a rocket and a satellite? **(4marks)**

11. Determine the de Broglie wavelength for the following: **(6marks)**

    (a) a moving golf ball (m = 0.05 kg, v = 40m/s)

    (b) an orbiting electron in the ground state of hydrogen (13.6 eV)

    (c) an electron accelerated through 100 kV in an electron microscope.

12. A vertical spring fixed at one end has a mass of 2 kg attached at the other end. The spring constant k = 5 N/ mm. Calculate: **(6marks)**

    a. the spring extension

    b. the elastic energy in the spring

13. A simple harmonic wave traveling along x-axis is given by

    $y = 5\sin 2\pi(0.2t - 0.5x)$ (where y is in meters and t in seconds)

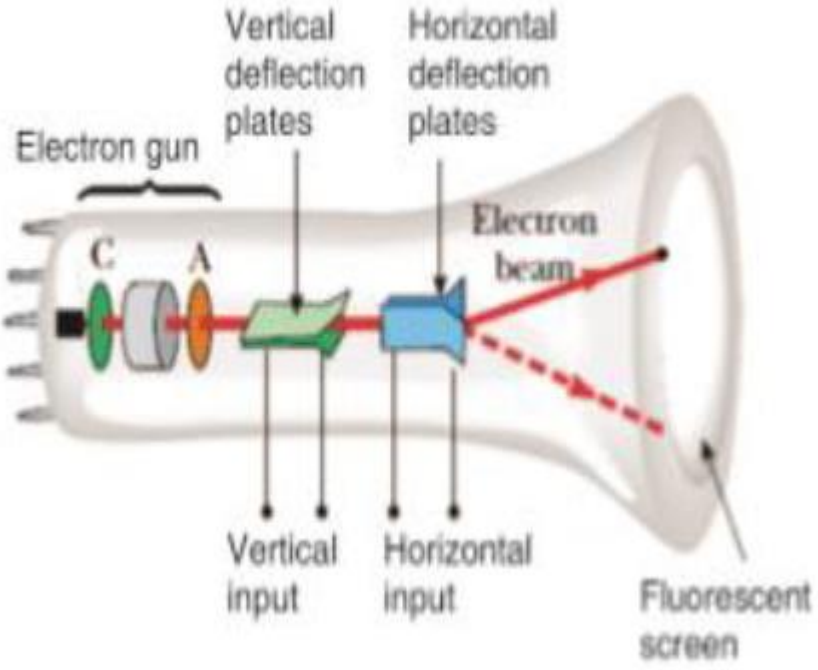
    Find: **(6marks)**

    a. the amplitude

    b. frequency

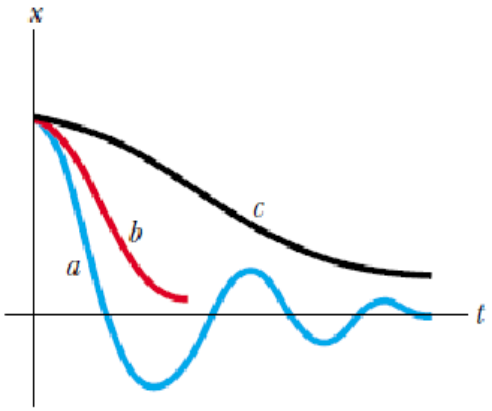
    c. wavelength

14. observe the following figure and answer the questions that follow.**(8marks)**



a. what does represent this figure?
b. Where is this applied?
c. Fill in the gaps with adequate missing words related to the figure above shown:
   i. The electron beam is produced by……, which is found at the neck of the tube.
   ii. …… oscilloscope is an instrument in laboratory to display measure and analyze wave forms of different circuit.

15. The resulting motion of damping objects is represented by the curve below:



a) Which Graph of position versus time represents:

i. an under damped oscillator **(1mark)**

ii. a critically damped oscillator **(1mark)**

iii. an over damped oscillator. **(1mark)**

b) The equation of motion for a damped oscillator is given by

$$4\frac{d^2x}{dt^2} + b\frac{dx}{dt} + 32x = 0$$

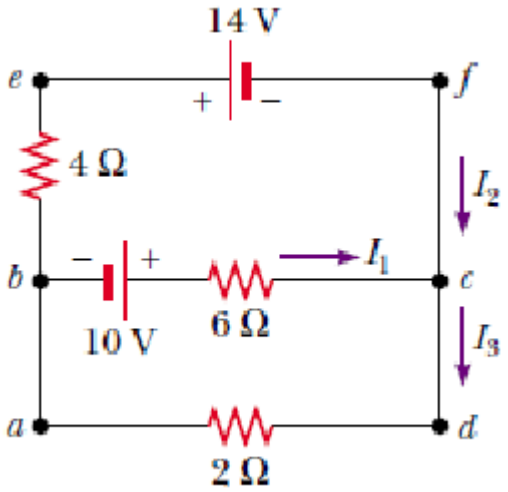
For what range of values for the damping constant will the motion be

(i)Under-damped **(2marks)**

(ii)Over-damped **(2marks)**

SECTIONB: Attempt any **three** questions **(30marks)**

16. In essay form, describe the environmental problems associated with the use of fossil fuels. **(10marks)**
17. Find the currents I_1, I_2, and I_3 in the circuit shown in Figure below. **(10marks)**



18. A 1.75−kg particle moves as function of time as follows:

$$x = 4\cos(1.33t+\pi/5)$$

where distance x is measured in metres and time t in seconds.

What is:

(a) the amplitude? **(1mark)**

(b) Frequency? **(1mark)**

(c) angular frequency? **(2marks)**

(d) period of this motion? **(1mark)**

(e) the equation of the velocity of this particle? **(2marks)**

(f) the equation of the acceleration of this particle? **(2marks)**

(g) What is the spring constant? **(1mark)**

19. A travelling wave is described by the equation

$$y(x,t) = 0.003\cos(20x + 200t)$$

where y and x are measured in metres and t in seconds.

(a)What is the direction in which the wave is travelling? **(1mark)**

(b)Calculate the following quantities:

(i)Angular wave number **(1mark)**

(ii)Angular frequency **(2marks)**

(iii)Wave speed **(2marks)**

(c)Calculate the particle velocity when x = 0.3m and t = 0.02s? **(2marks)**

(d)Calculate the particle acceleration when x = 0.3m and t = 0.02s? **(2marks)**

20. (a)State Newton's law of universal gravitation. **(2marks)**

(b)Using Newton's law of gravitation (formula) and the force that keeps the planet in circular paths (centripetal force), derive the expression for Kepler's third law of planetary motion. **(4marks)**

(c) A 50 kg person and a 70kg person are sitting on a bench close to each other in 50cm from each other. Estimate the magnitude of the gravitational force each exerts on the other. **(4marks)**

END